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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/623,678	07/21/2003	David L. Carnahan	NANO-6	5076
7590		08/24/2004	EXAMINER	
Pandiscio & Pandiscio		BERRY, RENEE R		
470 Totten Pond Road		ART UNIT		
Waltham, MA 02154		PAPER NUMBER		
		2818		

DATE MAILED: 08/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/623,678

Applicant(s)

CARNAHAN, DAVID L.

Examiner

Renee R Berry

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) 1-10 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 11-53 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group II in the reply filed on April 15, 2004 is acknowledged.

Claims 1-10 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on April 14, 2004.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 11-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,518,194 to Winningham et al. in view of US Patent No. 6,706,402 to Rueckes et al.

In regards to claim 11, Winningham teaches a method for generating a mask having nanoscale pattern, the method comprising: suspending a periodic arrangement of objects on a top surface of supporting liquid at a first given height above a top surface of substrate; and adjusting at least one from a group consisting the top surface of the supporting liquid and the top surface the substrate to position the top surface of the supporting liquid below the top surface

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of substrate so as to deposit the periodic arrangement of objects onto the top surface of the substrate from the suspension on the top surface the supporting liquid; wherein the periodic arrangement of objects maintained over a given area at column 18, lines 56-67 to column 19, lines 1-3.

In regards to claim 12, Winningham teaches a method according to claim 11 wherein the given area at least one square centimeter at column 5, lines 18-22.

In regards to claim 13, Winningham teaches a method according to claim 11 wherein the objects comprise micro-scale particles at column 5, lines 3-11.

In regards to claim 14, Winningham teaches a method according to claim 11 wherein the objects comprise nano-scale particles at column 5, lines 3-11.

In regards to claim 15, Winningham teaches a method according to claim 14 wherein the nano-scale particles have a diameter within the range of about 10 nanometers to about 5000 nanometers at column 5, lines 18-22.

In regards to claim 16, Winningham teaches a method according to claim 11 wherein the objects comprise monodisperse objects with a standard deviation of less than 5% of the particle size at column 14, lines 19-23.

In regards to claim 17, Winningham teaches a method according claim 11 wherein the objects have a generally spherical shape at Figure #1, reference number 18.

In regards to claim 18, Winningham teaches a method according to claim 11 wherein the objects have a generally cubic shape at column 14, lines 61-65.

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In regards to claim 19, Winningham teaches a method according to claim wherein the objects have a generally regular shape at column 14, lines 61-65.

In regards to claim 20, Winningham teaches a method according to claim wherein the objects comprise multiple sizes of particles at column 3, lines 65-67 to column 4, lines 1-2.

In regards to claim 21, Winningham teaches a method according to claim wherein the objects comprises at least one from a group consisting polystyrene, melamine, polydivinylbenzene, polymethyl methacrylate, polystyrene-co-divinylbenzene), polystyrene-co-methacrylic methylester) copolymers, and silica at column 7, lines 17-25.

In regards to claim 22, Winningham teaches a method objects comprise according to claim 11 wherein the organic spherical particles at column 14, lines 46-54.

In regards to claim 23, Winningham teaches a method according to claim 11 wherein the organic spherical particles comprise viruses at column 14, lines 46-54.

In regards to claim 24, Winningham teaches a method according claim 11 wherein the substrate comprises an insulator material at column 10, lines 9-19.

In regards to claim 25, Winningham teaches a method according claim 11 substrate comprises a conductor material at column 10, lines 9-19.

In regards to claim 26, Winningham teaches a method according substrate comprises wherein a semiconductor material at column 6, lines 59-62.

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In regards to claim 27, Winningham teaches a method according claim 11 wherein the substrate comprises at least one from a group consisting of glass, silicon, graphite and metal at column 6, lines 50-57.

In regards to claim 28, Winningham teaches a method according claim 11 wherein the substrate comprises a smooth surface having a roughness of less than about 50 nanometers at column 5, lines 18-22.

In regards to claim 29, Winningham teaches a method according claim 11 wherein the substrate comprises a smooth surface having a roughness of less than about 10 nanometers at column 5, lines 18-22.

In regards to claim 31, Winningham teaches a method according to claim further comprising the step of adding a surfactant to the suspension so as to alter a charge of the objects at column 9, lines 51-54.

In regards to claim 32, Winningham teaches a method according to claim 31 wherein the surfactant comprises a cationic surfactant at column 9, lines 51-54.

In regards to claim 33, Winningham teaches a method according to claim 32 wherein the cationic surfactant comprises sodium dodecyl sulfate ($\text{C}_{12}\text{H}_{25}\text{NaO}_4\text{S}$) at column 9, lines 51-54.

In regards to claim 34, Winningham teaches a method according to claim 31 wherein the surfactant comprises an anionic surfactant at column 9, lines 51-54.

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In regards to claim 35, Winningham teaches a method according anionic surfactant comprises claim 34 wherein the fatty acid amine at column 15, lines 47-51.

In regards to claim 36, Winningham teaches a method according to claim wherein the surfactant comprises nonionic surfactants at column 9, lines 51-54.

In regard to claim 37, Winningham teaches a method according to claim 36 wherein the nonionic surfactants comprises polyethylene glycol at column 9, lines 51-54.

In regards to claim 41, Winningham teaches a method according to claim 40 wherein the controlled orientation is determined by optical diffraction at column 13, lines 4-5 and column 14, lines 29-31.

In regards to claim 43, Winningham teaches a method wherein the step of depositing the material through the interstices contained in the periodic arrangement objects the mask comprises one from a group consisting of sputtering, evaporation and spraying of a colloidal solution at column 7, lines 34-40.

In regards to claim 44, Winningham teaches a method according to claim 42 wherein the material comprises one from a group consisting of a metal, an insulator, and a semiconductor at column 10, lines 9-25

In regards to claim 50, Winningham teaches a method according to claim 42 wherein the hexagonal monolayer pattern on the substrate comprise a structure at column 14, lines 38-44.

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In regards to claim 51, Winningham teaches a method according claim 42 wherein the pattern on the substrate structure comprises a cubic monolayer at column 14, lines 38-44.

However, Winningham does not teach all the claim limitations.

In regards to claim 38, Rueckes teaches a method according to claim further comprising the step of arranging the objects into monolayer array with a long range order at column 5, lines 51-58.

In regards to claim 39, Rueckes teaches a method according to claim further comprising the step of arranging the objects into a multilayer array with a long range order at column 5, lines 51-58.

In regards to claim 40, Rueckes teaches a method according claim 11 further comprising sequential repetition the step of suspending the periodic arrangement of objects on the top surface of the supporting liquid at the first given height above the top surface the substrate and the step of adjusting at least one of the top surface of the supporting liquid and the top surface of the substrate to position the top surface of the supporting liquid below the top surface of the substrate so as to fabricate multilayer arrays having a controlled orientation of discrete layers.

In regards to claim 42, Rueckes teaches a method for creating a deposition having nanoscale pattern on a substrate, the method comprising: periodic arrangement of objects on a top surface of a supporting liquid at a first given height above suspending a top surface of a substrate; adjusting at least one from a group consisting of top surface of the fluid and the top surface of the

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substrate position the top surface of the supporting liquid below the top surface of the substrate so as deposit the periodic arrangement objects onto the top surface of the substrate from the suspension on the top surface of the fluid, whereby to create mask; and depositing a material through interstices contained in the mask so as create a pattern on the substrate at column 12, lines 31-46.

In regards to claim 45, Rueckes teaches a method according to claim wherein the material comprises a catalytic metal for growth of carbon nanotubes at column 12, lines 13-6 and 17-22.

In regards to claim 46, Rueckes teaches a method according to claim 42 further comprising the step of stripping the mask from the substrate by chemical dissolution solvent subsequent to the step of depositing the material through the interstices contained in the mask so as to leave the material deposited on the substrate where the interstitial sites previously existed at column 12, lines 31-42.

In regards to claim 47, Rueckes teaches a method according to claim solvent is THF at column 12, lines 31-42.

In regards to claim 48, Rueckes teaches a method according claim 42 wherein the material precludes carbon nanotube growth at column 11, lines 42-45.

In regards to claim 49, Rueckes teaches a method according claim 42 wherein the step of depositing the material through the interstices contained in the periodic arrangement of the mask comprises depositing a portion of the material above a top surface the objects, and further comprising the step of

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dissolving the objects so as to create a freestanding film of material containing perforations corresponding to wherein the interstitial sites previously existed at column 13, lines 16-23.

In regards to claim 52, Rueckes teaches a method according to claim 42 wherein the pattern on the substrate comprises a multi-dimensional structure at column 11, lines 47-53.

In regards to claim 53, Rueckes teaches a method according to claim 42 wherein the material deposited on the substrate comprises features having a vertical height less than about 300 nanometers on an edge thereof, and further wherein the material comprises a catalytic material for growth of carbon nanotubes suited to form a single nanotube at column 12, lines 13-16.

Therefore, it would have been obvious to one having ordinary skill at the time the invention was made to have modified Winningham to include a method for creating a deposition having nanoscale pattern on a substrate, the method comprising: periodic arrangement of objects on a top surface of a supporting liquid at a first given height above suspending a top surface of a substrate; adjusting at least one from a group consisting of top surface of the fluid and the top surface of the substrate position the top surface of the supporting liquid below the top surface of the substrate so as deposit the periodic arrangement objects onto the top surface of the substrate from the suspension on the top surface of the fluid, whereby to create mask; and depositing a material through interstices contained in the mask so as create a pattern on the substrate, since such a

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modification would result in conductive nanotubes and articles that may operate well in contexts having high current densities or in extreme thermal conditions, as described in column 1, lines 50-57 of Rueckes et al.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US Patent No. 6,764,874 to Zhang et al. discloses method of depositing nanotubes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Renee R Berry whose telephone number is (571) 272-1774. The examiner can normally be reached on M-F 9-5:30.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



RRB



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